Dictyostelium was obtained in similar cultures made from two plots of Leonardtown loam under experimental study in the greenhouse including one plot limed to pH 7.1 and the other with about pH 4.2. Cultures from six other plots in the greenhouse showed abundant amoeboids, but no myxomycete was positively identified.

Among the other experiments already performed, the effect of seasonal changes in temperature have been rather striking. The plasmodia in culture were not much affected by small changes of temperature, but have shown decided dislike for temperatures above 20–22°C. This was particularly evident during the latter part of April and the early part of May, when there was extremely warm weather. The plasmodia growing in the laboratory prior to this became less active and grew very slowly. During the following week this effect was even more pronounced. Plasmodia in most cases broke up into sclerotia and in many cases disintegrated quite completely. Those that were still viable were placed in an incubator with a temperature range of from 15 to 18°C. Within a very short time normal growth and activity were resumed. Subsequent culture experiments have been carried at both incubation temperatures with the forms in culture showing decided preference for the cooler condition.

In another series of studies, dilution cultures at 1 to 50, 1 to 500 and 1 to 5,000 were made to test the presence of protozoa in plots of land containing decomposing rye and vetch. In certain of these cultures, amoeboid organisms were predominant. Mannite plates were streaked from these tubes. Of 15 such cultures, one produced *Dictyostelium* and another produced plasmodia.

These observations are recorded to call attention to the presence of myxomycete amoeboids as part of the soil population. Experiments in culture of these forms and efforts to determine their function as part of such populations are in progress. Meanwhile search of the literature furnished little information on the occurrence of Myxomycetes in the soil, and no direct reference to the isolation of plasmodia from decaying vegetation under winter conditions such as described in this paper. The following references are worthy of note: Miller (6) working in the Johns Hopkins Medical laboratories obtained *Stemonitis* plasmodia as contaminants in protozoa cultures which were being grown in tap water to which had been added unsterilized hay. He then collected hay from various sources and again plasmodia were obtained. He expresses the opinion that "plasmodia are constantly present on hay in one form or another." Lister (5) in his monograph of the Mycetozoa lists dead leaves and twigs as the most

common substrate for members of the genus *Physarum*. Also of interest here are *P. fulvum* gathered in Colorado at an elevation of 11,000 feet on "living willow, growing in snow," and *P. vernum* which is frequently found in the Swiss Alps growing "on leaves and grass close to the melting snow." Krzemieniewski (4) working in Poland found *Dictyostelium mucoroides* "in almost all soils examined," and species of *Polysphondylium*, though rarely, in uncultivated soils.

In seeking current information several visitors were consulted and the cultures exhibited. Professor George W. Martin of the University of Iowa was shown these cultures but had no record of such observations. Professor Robert F. Griggs of George Washington University reported having often seen a myxomycete fruiting upon the grass in his lawn in summer but that he had made no further study. Professor J. B. S. Norton of the University of Maryland reported similar observations upon the University campus. Professor H. H. Bartlett of the University of Michigan told of plowing an area in the Botanical garden at Ann Arbor and seeing large plasmodia come out upon the surface of the plowed ground and looking "like pancakes scattered over the field." From these reports it is clear that a considerable number of workers have been familiar with the occurrence of these species in cultivated land.

Professor R. A. Harper in his recent paper upon *Polysphondylium* and in conversation about this work attributed the suggestion of his method of isolation to Krzemieniewski and on the basis of his own rediscovery of that species in soil from the parks of New York City, suggested that the amoeboid forms of myxomycetes would probably be found to account for many of the amoebae reported by soil workers.

CONCLUSION

In these experiments with soil from Arlington farm in Virginia and tobacco plots in Marlboro, Md., the myxomycetes have been found to constitute an active component of the micro-population in the decaying vegetation and in the underlying soil.

Myxamoebae and plasmodia were developed in the colder part of the season and have been found to grow better at 15 to 18°C. than at 20 to 22°C. Myxamoebae at least if not the more complex plasmodia were found abundantly upon all parts of the grasses and weeds taken from our experimental plots between December and May 1930.

Members of this group should be considered in surveying the types of microörganisms present in any soil population.

LITERATURE CITED

1 BRIERLEY, W. B. *The microflora of the soil.* Jour. Quekett Microscopical Club **16**: 16. 1928.
2 HARPER, R. A. *Morphogenesis in* Dictyostelium. Bull. Torrey Bot. Club **53**: 229–268. 1926.
3 HARPER, R. A. *Morphogenesis in* Polysphondylium. Bull. Torrey Bot. Club. **56**: 227–258. 1929.
4 KRZEMIENIEWSKI, HELENA S. *"Z Mikroflory gleby w Polsce" (Contribution à la microflore du sol en Pologne)* Acta. soc. Bot. Poloniae **4**: 141–144. 1927.
5 LISTER, A. & G. *A monograph of the Mycetozoa.* British Museum, 1911.
6 MILLER, C. O. *The aseptic cultivation of Mycetozoa.* Quart. Journ. Micr. Soc. **41**: 43–71. 1898.
7 SANDON, H. *The composition and distribution of the protozoan forms of the soil.* Pp. 237. Edinburgh and London, 1927.
8 WAKSMAN, S. A. *Principles of soil microbiology.* 311–340. 1927.

PALEONTOLOGY.—*Discovery of Permo-Carboniferous vertebrates in the Dunkard formation of West Virginia.*[1]

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On December 27, 1929 Mr. Goff Carder reported to Professor R. W. Whipple the discovery of certain bones at Portland, Jackson County, West Virginia. Professor Whipple visited the locality and determined the horizon to be the Upper Marietta sandstone, which is in the lower portion of the Dunkard. The Marietta sandstones, named by I. C. White[2] from their typical outcrop in the vicinity of Marietta, Ohio, are easily recognized in this area; and in the interval between the Lower Marietta sandstone and the Upper Marietta sandstone are shaly sandstones, shales and red clay (Creston beds). The bones are from the lower part of the Upper Marietta sandstone 130 feet above the railroad track over Skull Run. The specimen was in a soft clayey cross-bedded sandstone, carrying an abundance of large flakes of white and black mica, made up of small rounded grains of quartz and the whole weathering to a light brown color.

The site was in the center of an old road and the specimen had been partly destroyed by passing wagons. All material that could be recovered was collected and has been studied by Professor E. C. Case. The specimen consists of parts of the spines, centra and ribs of *Edaphosaurus cruciger* Cope. More than half of four spines have been pieced together; there are in addition two nearly complete centra of

[1] Received June 23, 1930.
[2] West Virginia Geological Survey **2**. 1903.